Coastal Flood Hazard Analysis for Vashon and Maury Islands

FEMA Region X

King County River and Floodplain Management Section

Public Meeting

April 28, 2011

FEMA

Agenda

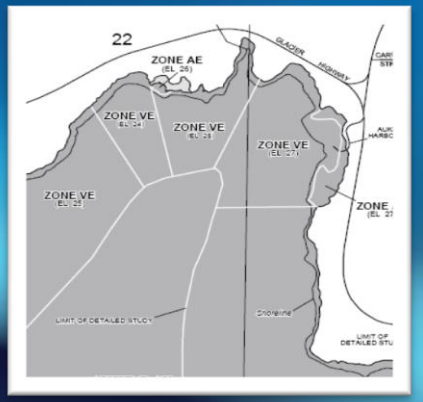
- Introductions
- Background on King County Flood Studies
- Technical Overview of Coastal Flood Hazard Study of Vashon and Maury Islands
- Overview of FEMA National Flood Insurance Program
- King County Proposed Coastal Flood Hazard Regulations
- Questions

Coastal High Hazard Area Flood Mapping

- Why do we need new flood hazard maps?
  - Current maps are approximate: flood zone A (largest A Zone in the County)
  - A Zones are not the result of technical analysis
  - Current maps are from the 70s and have known errors: high bluffs mapped in the flood zone.
  - New maps created from current data and analytic methods.

Key Technical Tasks

- Field Surveys and Reconnaissance
- New Aerial Photography
- Topographic Data Development
- Offshore Wave Modeling
- Nearshore Hydraulic Modeling
- Statistical Analysis/Floodplain Mapping
- Sea-level Rise Evaluation

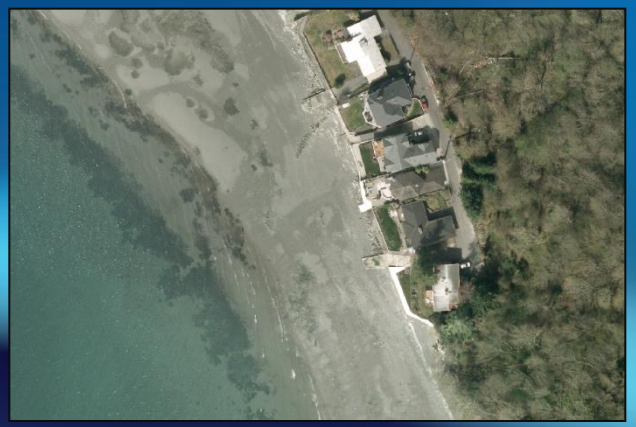


Field Surveys and Reconnaissance

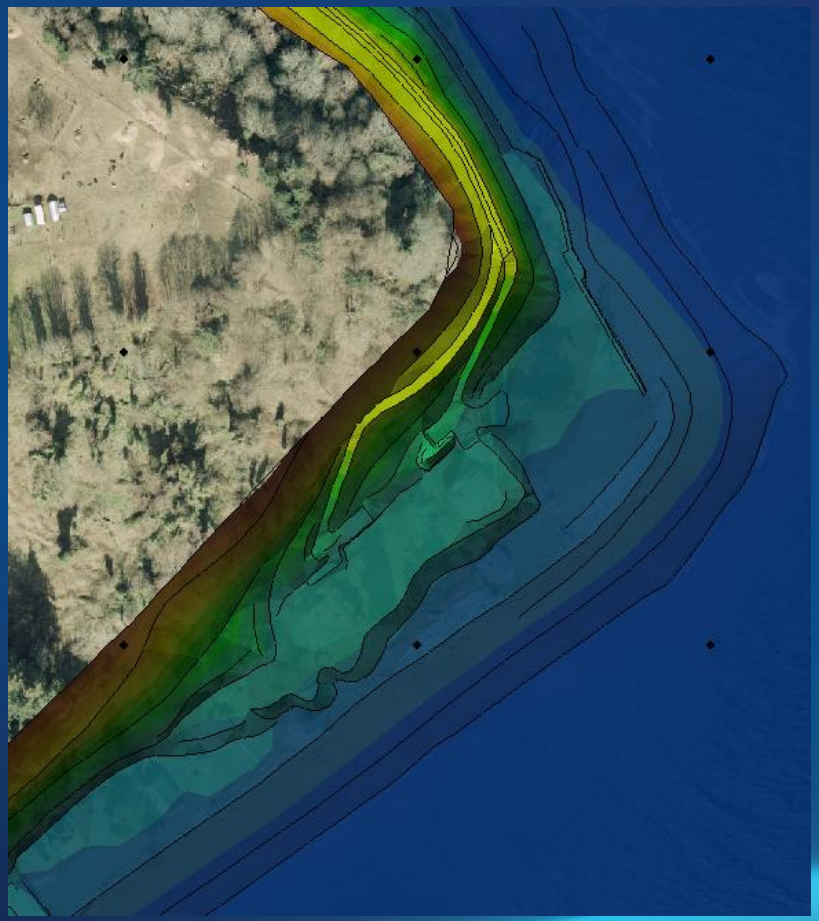
- Field Reconnaissance by King County and NHC staff on August 17, 2009
- Supported by Pacific Geomatic Services survey boat
- Collected video and photographic information

Aerial Photography

- Aerial photography of Vashon-Maury Island on March 11, 2009
- Individual Digital Photo Tiles and MrSID mosaic
- Data used for detailed topographic mapping and feature data collection of shoreline areas

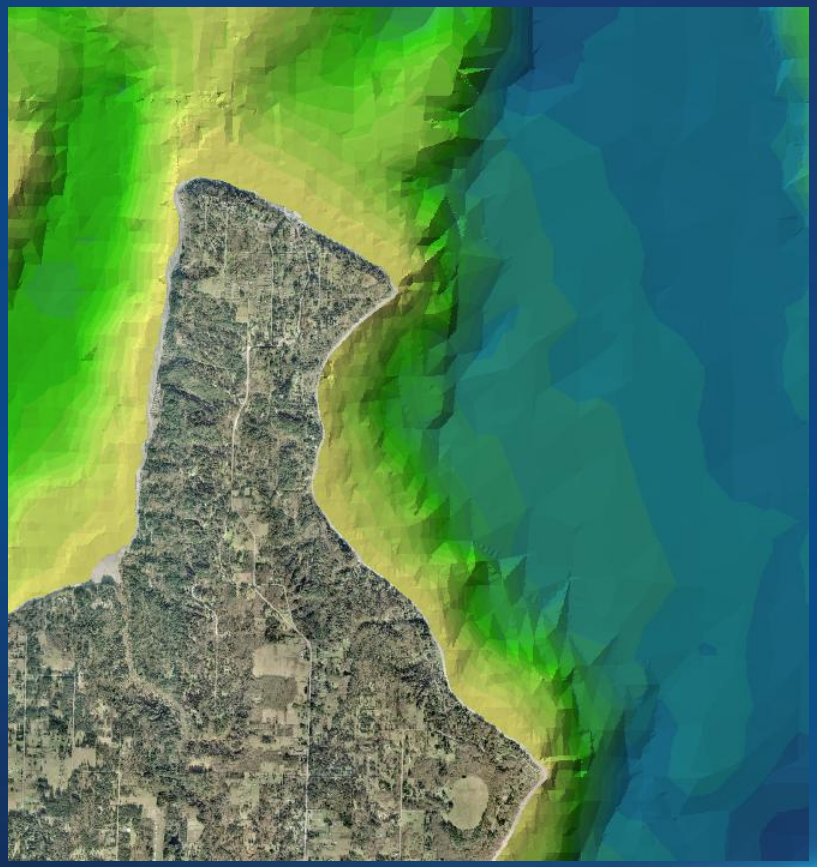


Topographic Data Development



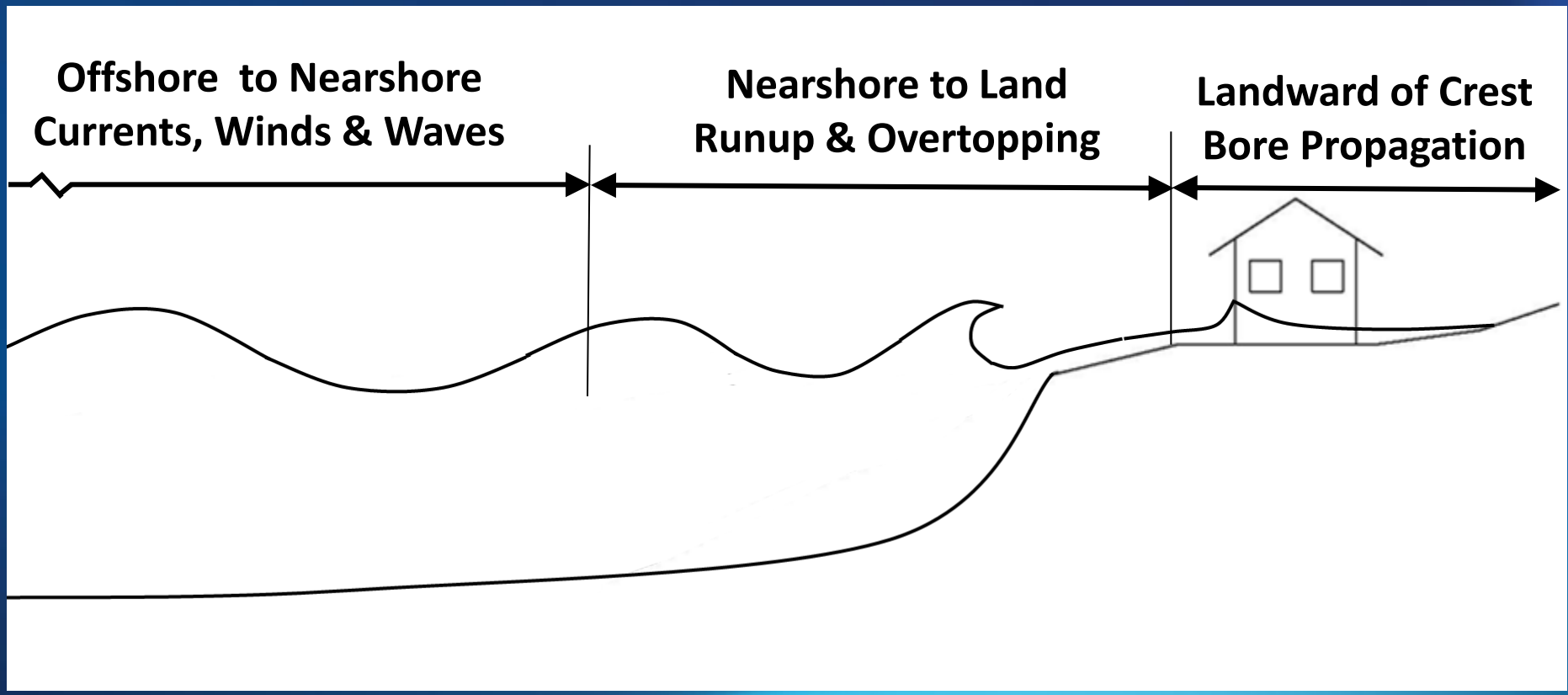
- Developed by 3DI-West using aerial imagery
- 2-foot contour mapping from 0-foot to 50-foot elevation or higher
- Topographic maps produced at a scale of 1 inch = 500 feet

Topographic Data Development



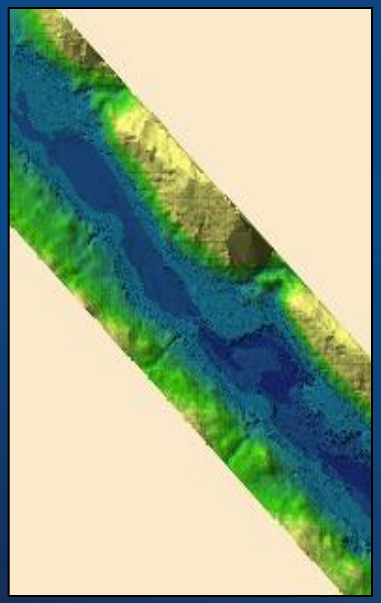
- Used NOAA bathymetric soundings – surveys conducted from early 1800s to present
- Merged with topographic data to create seamless bathymetric surface

Numerical Analyses

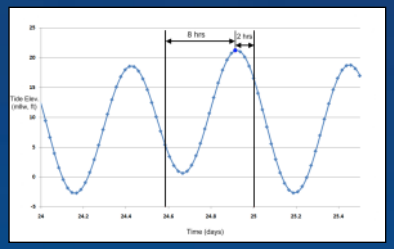


Offshore to Nearshore – Wave Modeling

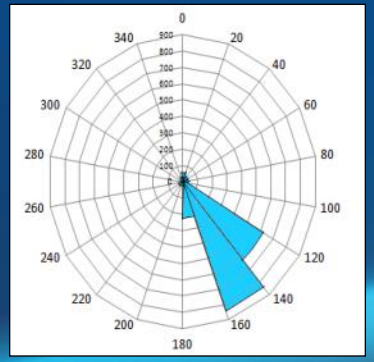
Bathymetry



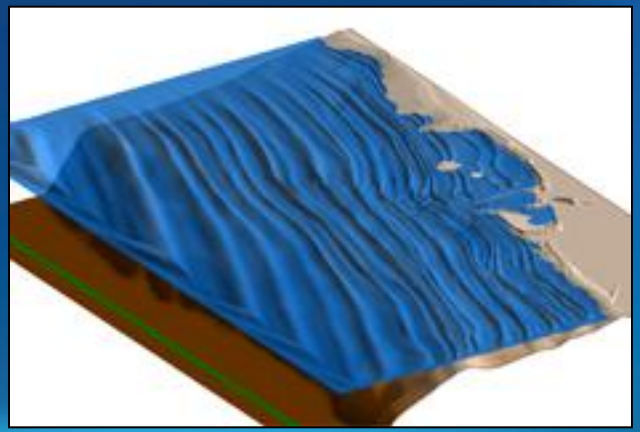
Tides



Wind



Waves



Offshore to Nearshore – Wave Modeling

Model Used

- Simulating WAves Nearshore (SWAN) [FEMA approved model]
- 2-D Wave Propagation and Wave Transformations

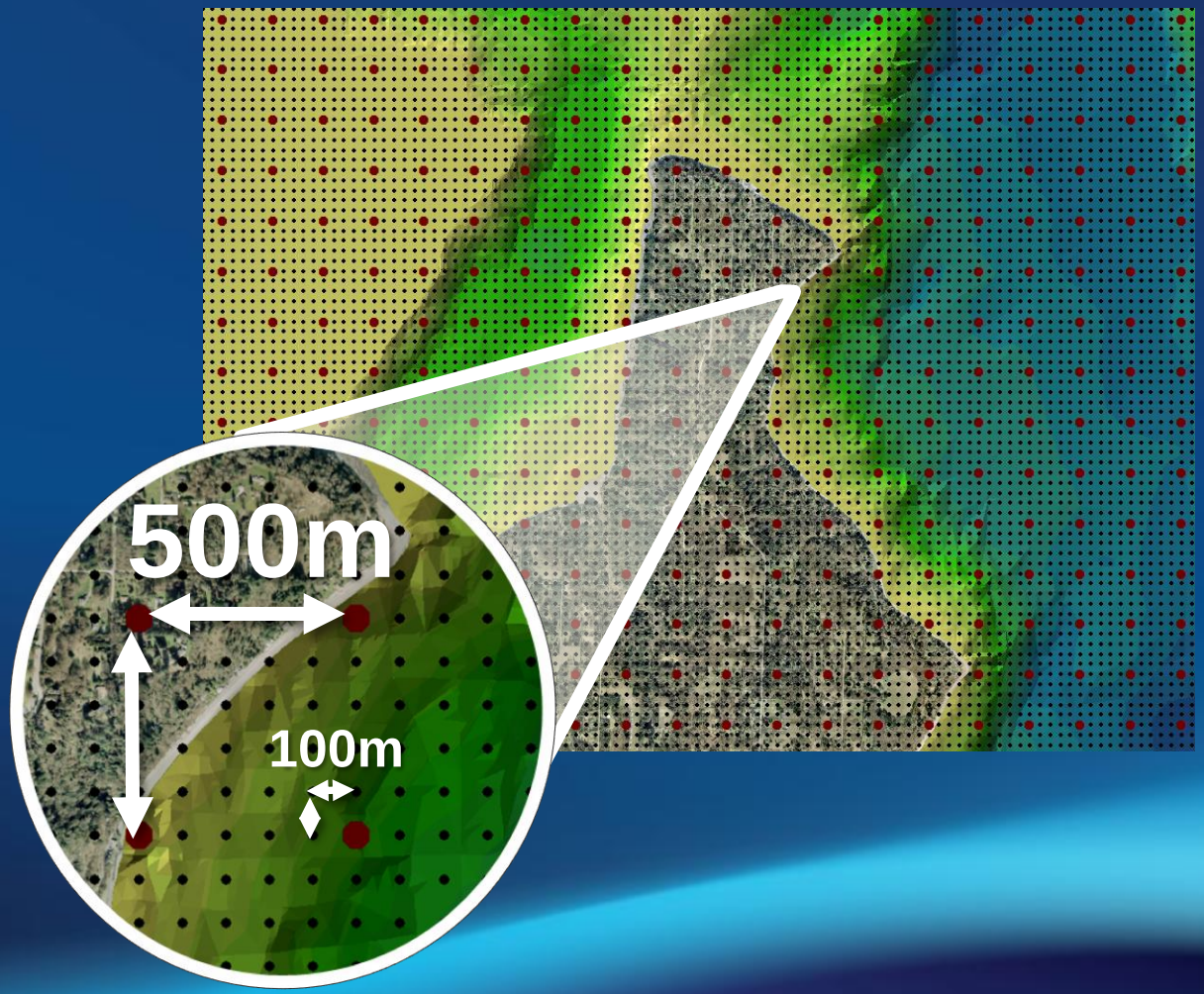
Model Input

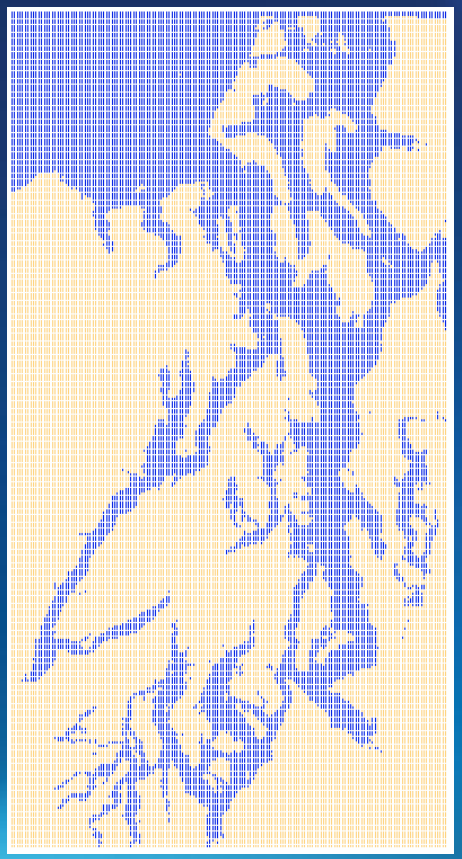
- NOAA Bathymetry data (underwater topography)
- Wind data

Model Output

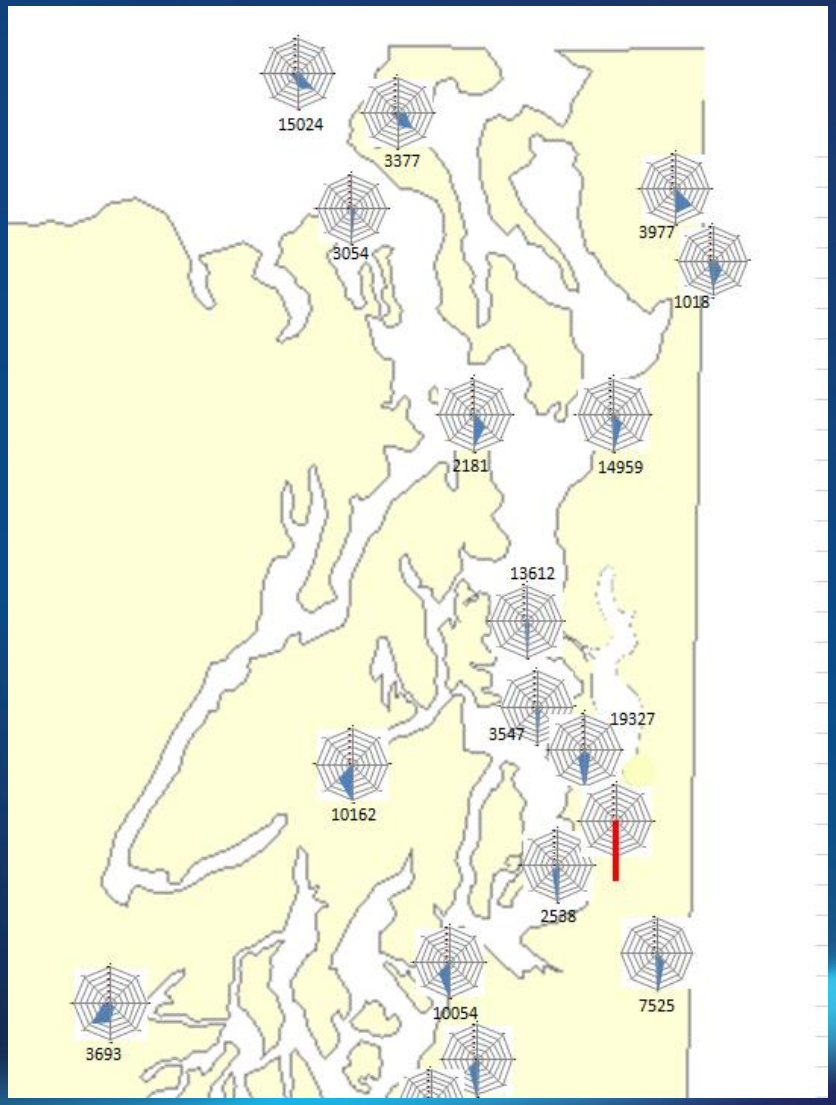
- Tidal Data
- Still Water Elevations
- Wave Heights, Velocities, Periods, and Directions

SWAN Model Domain and Grid





SWAN Model Input - Wind Data



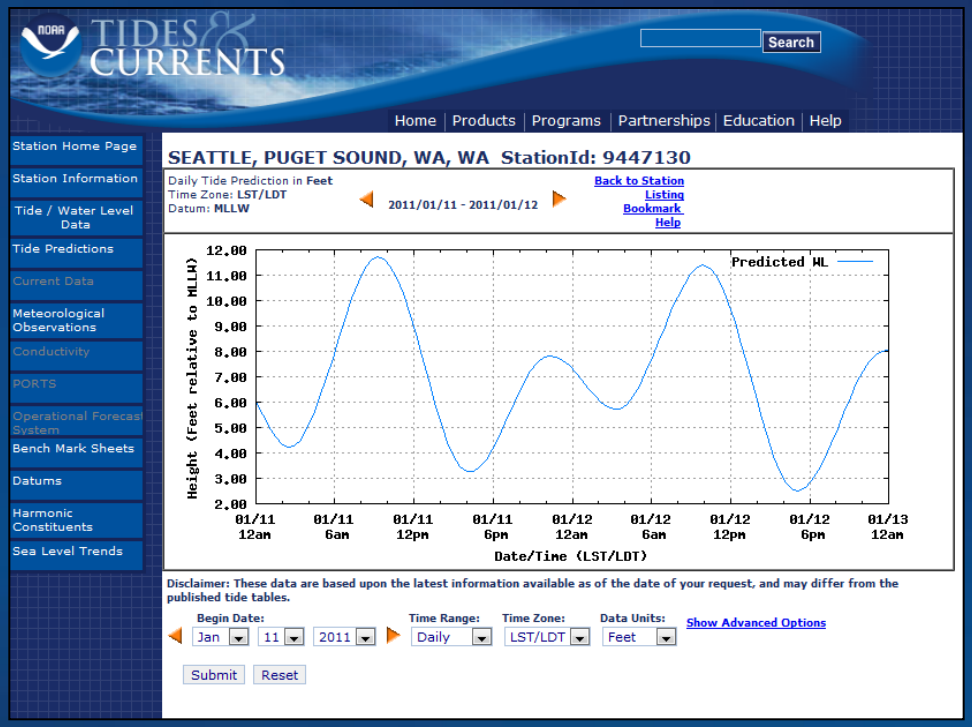
Primary Historic Record

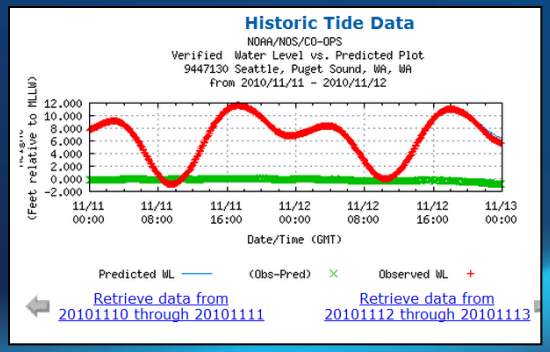
- 60 years of NWS observations at SeaTac

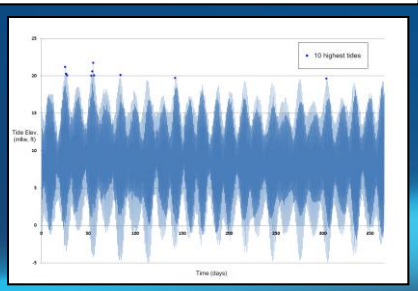
Spatial Distribution

- Correlation with 15 regional wind gages

SWAN Model Input - Tide Data







Predicted Tides

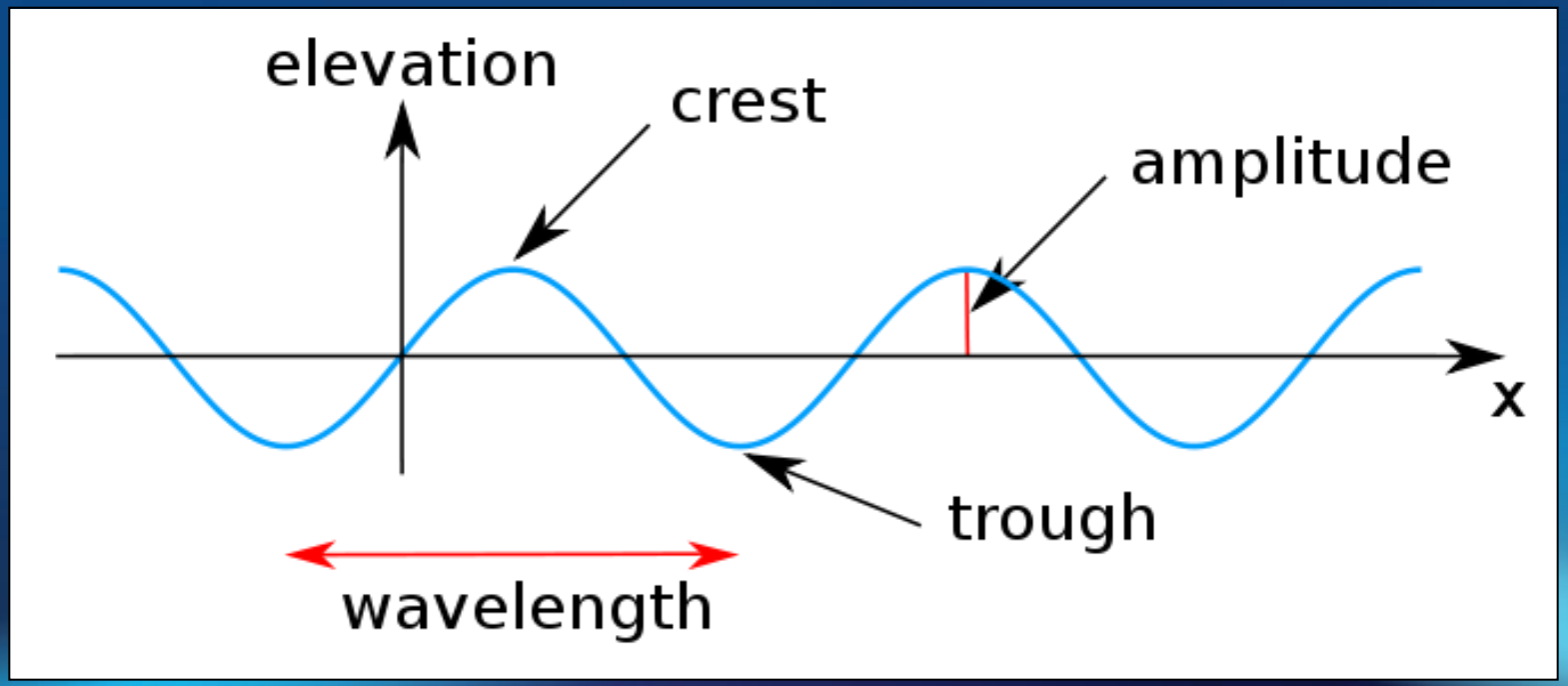
- Based on astronomical constants
- Repeating pattern every 18.6 years

Residuals (difference between observed and predicted)

- Based on 70 years of data at Seattle NOAA gage
- Residual = Observed – Predicted Tide
- Statistical analysis of residuals

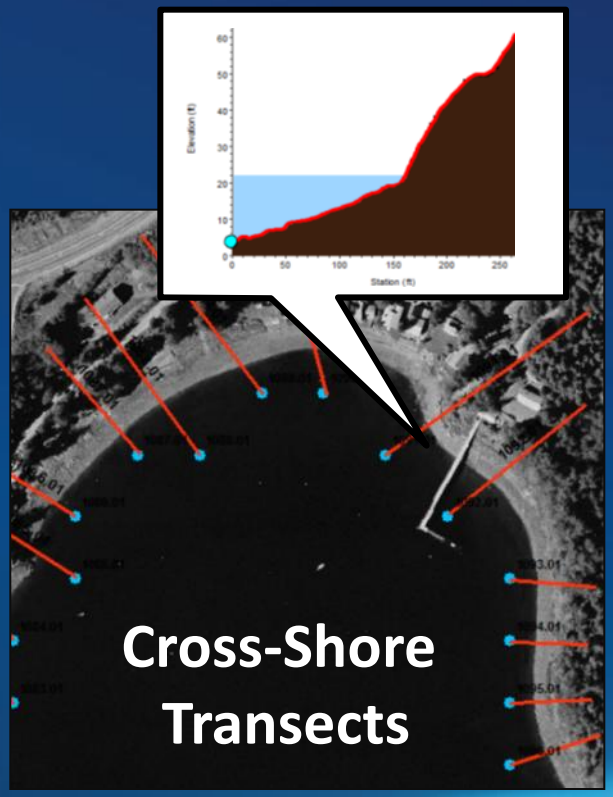
SWAN Model Output

- Still Water Elevations
- Wave Height
- Wave Period
- Wave Length
- Wave Direction



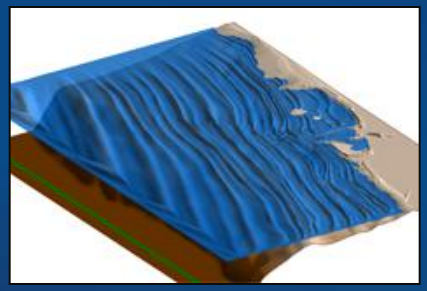
Nearshore to Land – Runup and Overtopping

Coastal Geometry



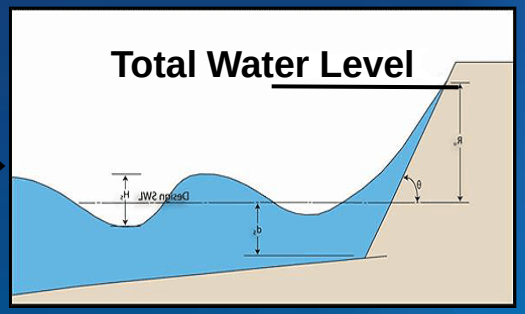
From Topography/
Bathymetry

Wave Data



From SWAN

Wave Runup



Using Methods and Equations from FEMA Pacific Coast Guidelines

Nearshore to Land – Runup and Overtopping

Model Used

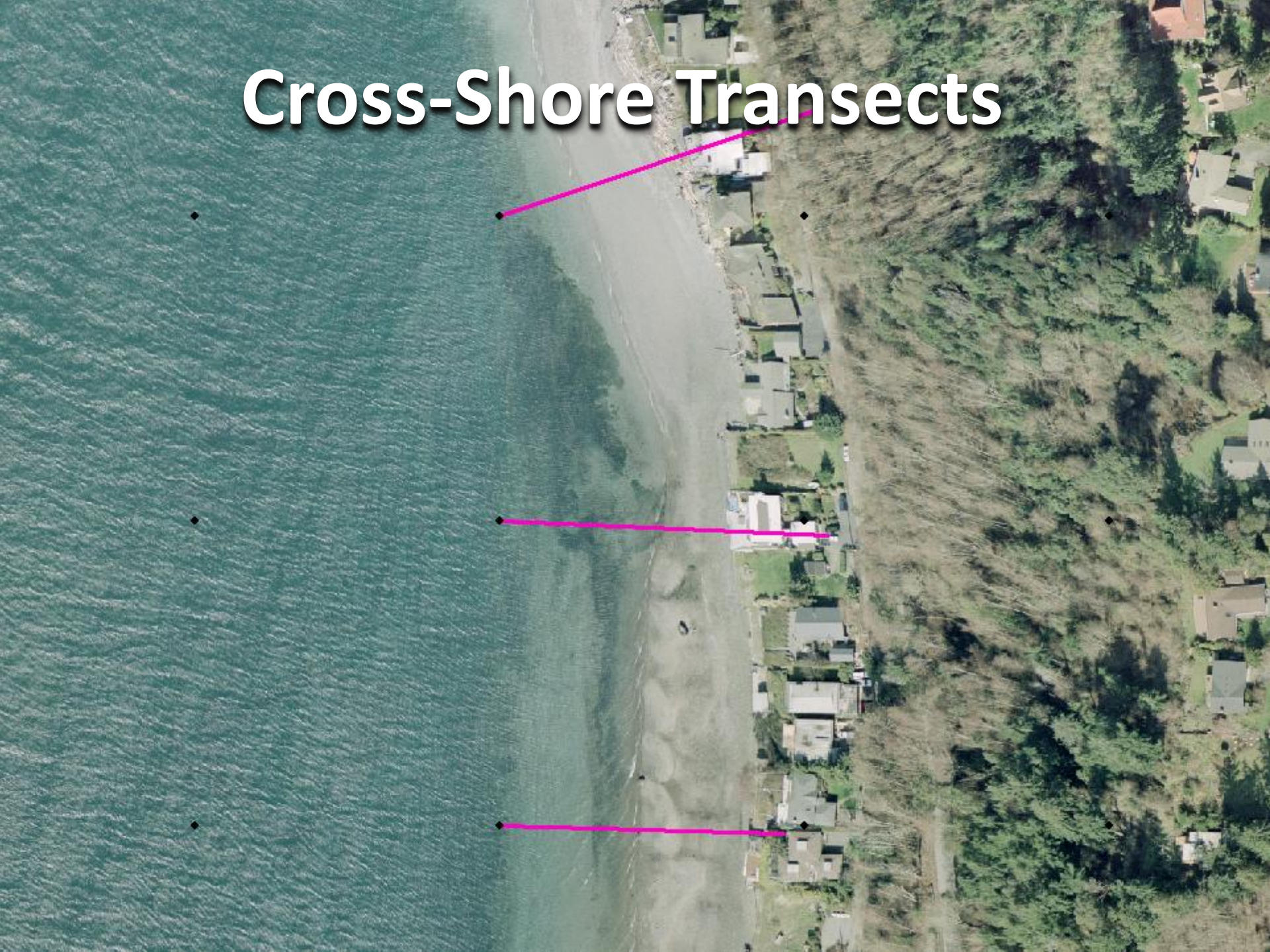
- FEMA Pacific Coast Guidelines
- Runup and Overtopping Equations for Beaches and Structures

Model Input

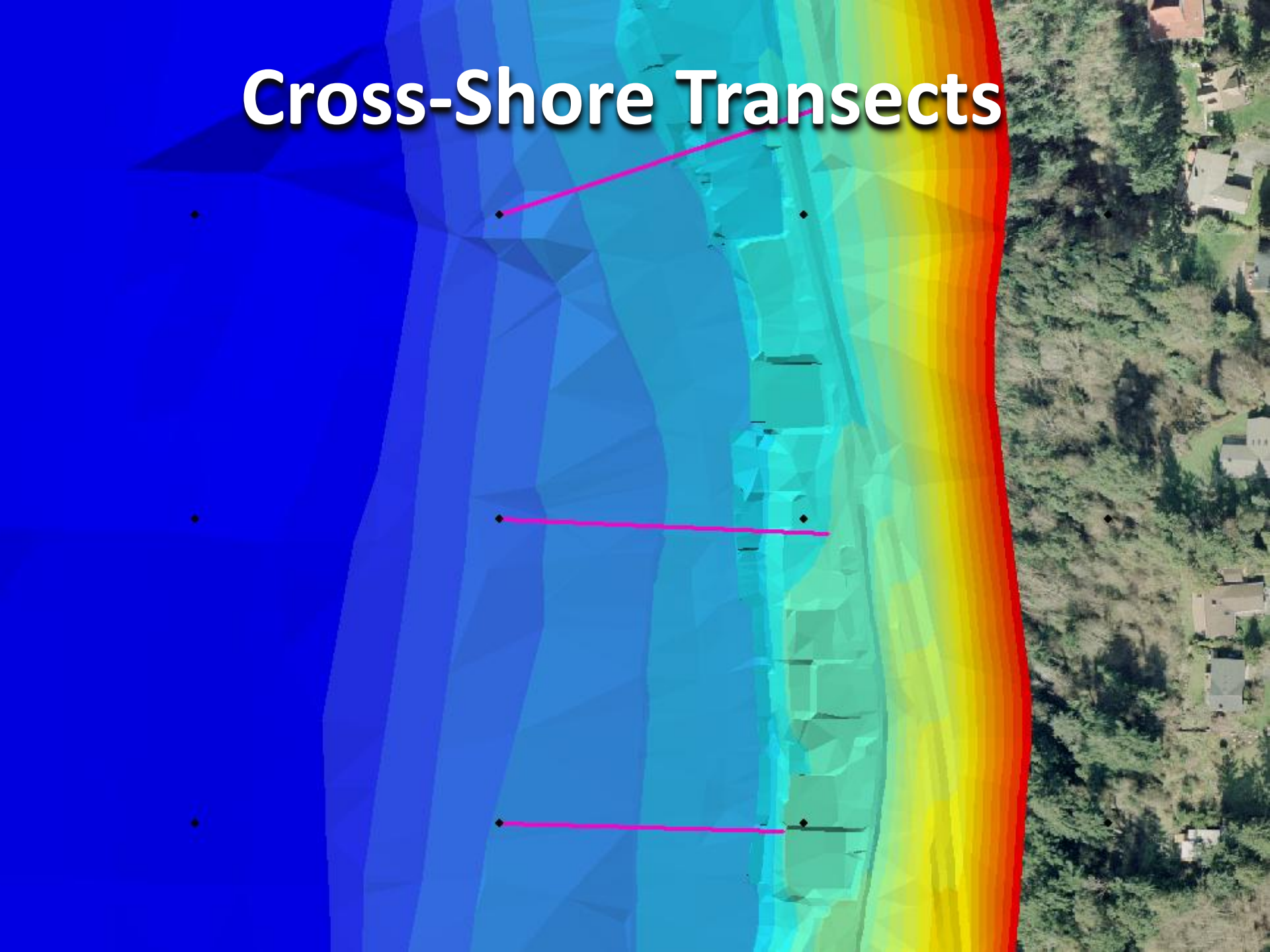
- Wave and Tide Data from SWAN Model
- Transect Geometry (bathymetry/aerial photogrammetry)
- Transect Characteristics (berms, toes, crests, surface roughness, shore angle, etc.)

Model Output

- Total Water Level (TWL) Elevations for Each Event

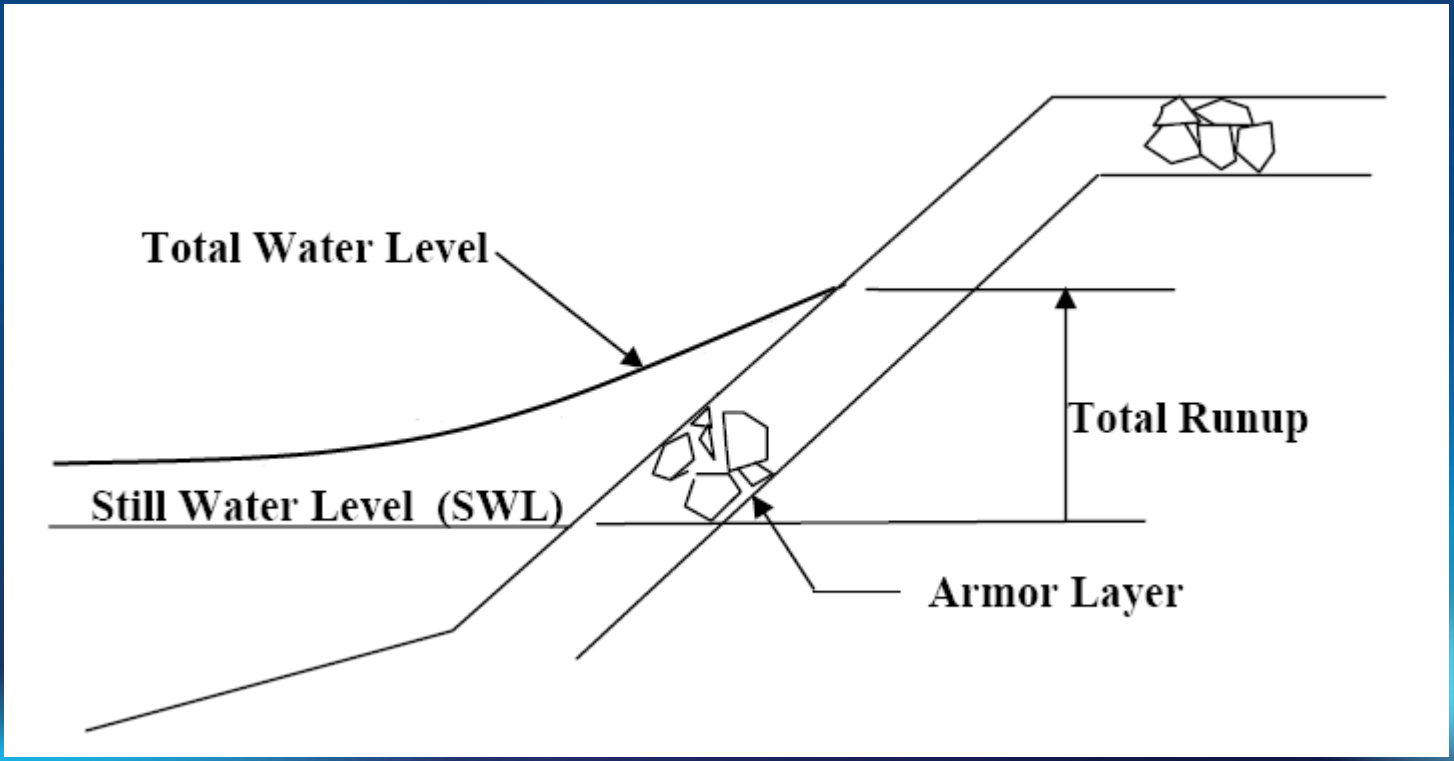

Cross-Shore Transects

Cross-Shore Transects



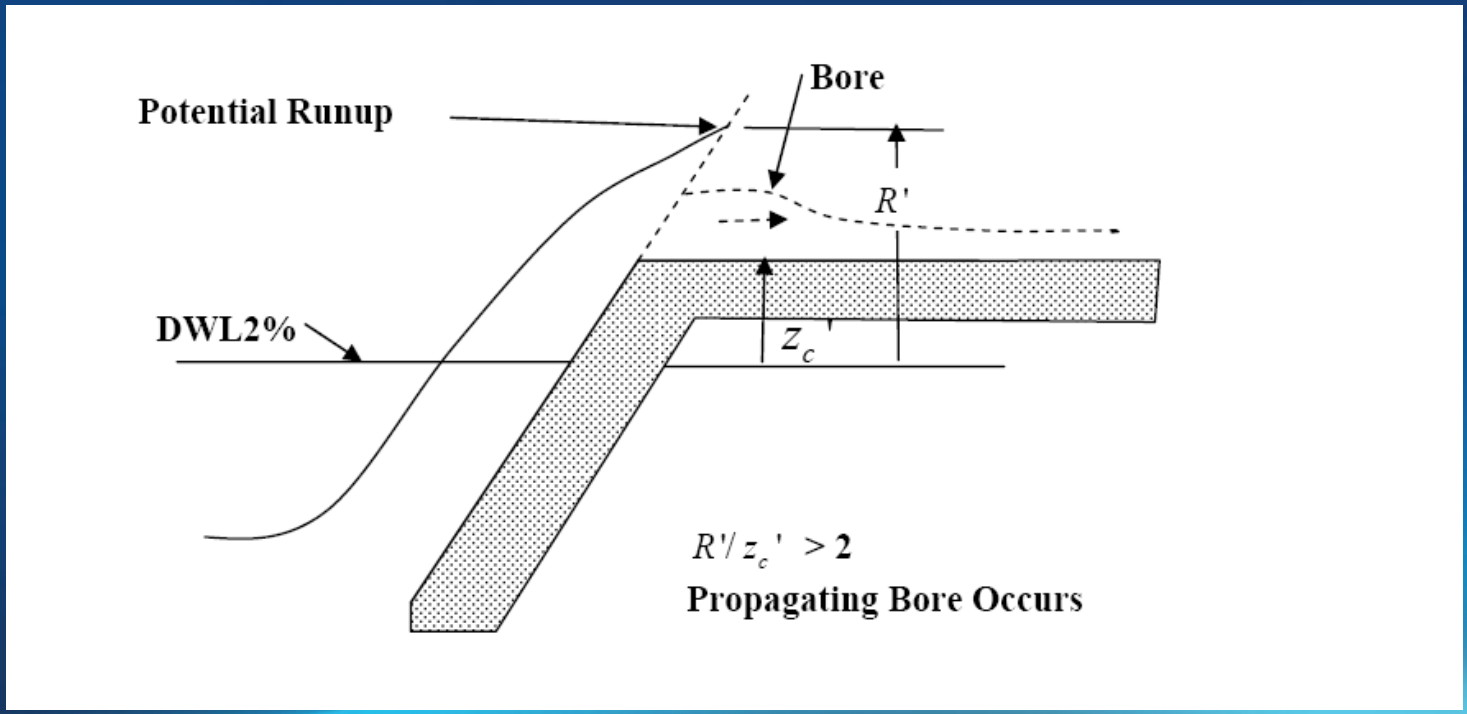
Nearshore to Land – Model Results

- Wave runup
- Total water level
- Overtopping (in some cases)



Landward of Crest (if overtopping occurs)

- Bore Propagation or Splash
- Elevation of AE Zone



Statistical Analysis

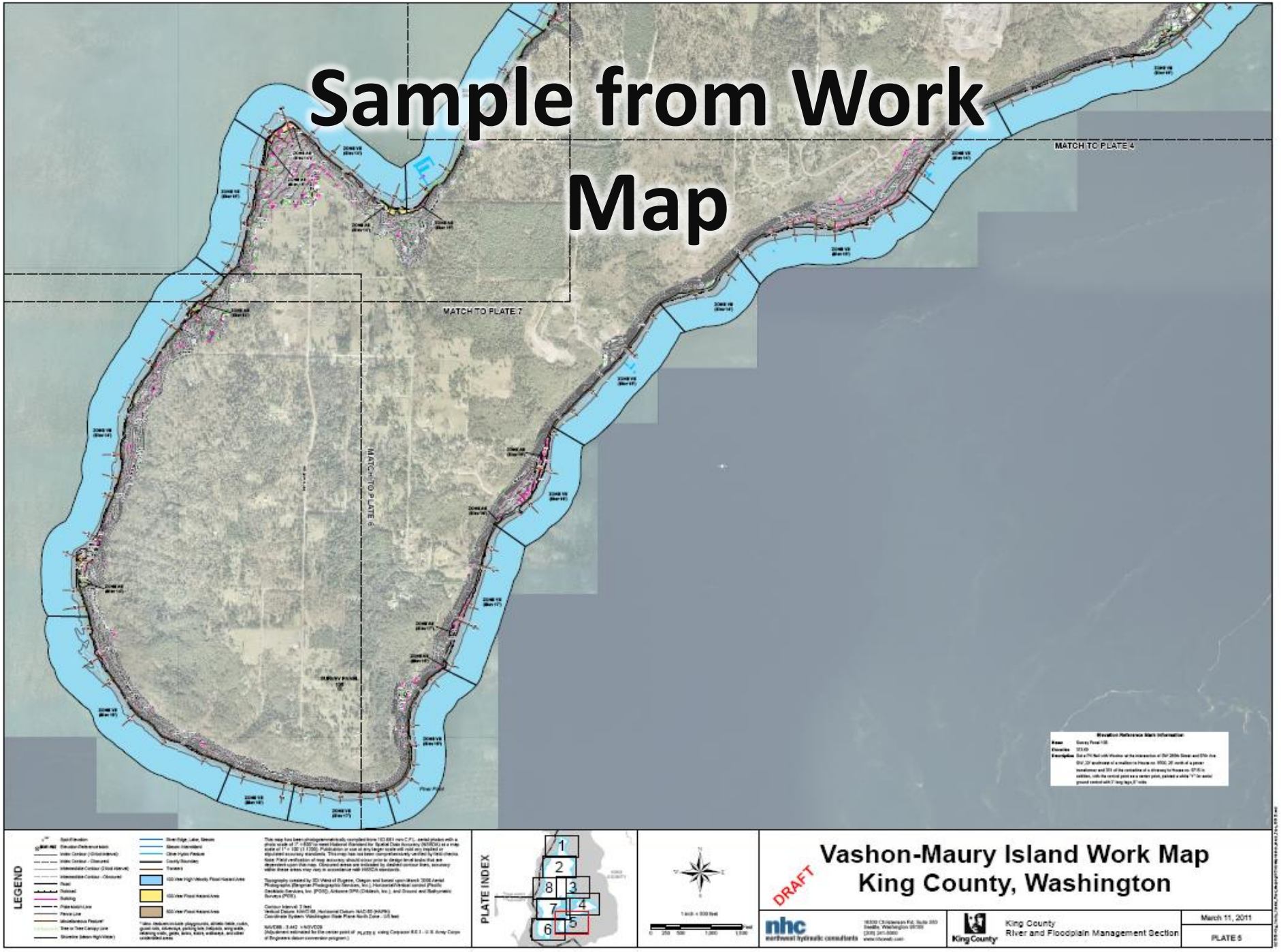
For Each Transect:

- Hypothetical 1000 year record of tides/winds/wave events created
- Detailed simulations performed for 10 highest tides and 10 highest wind events in each year
- 100-year and 500-year event data for total water level, overtopping flows, and inland extent of flooding extracted from 1000-year record

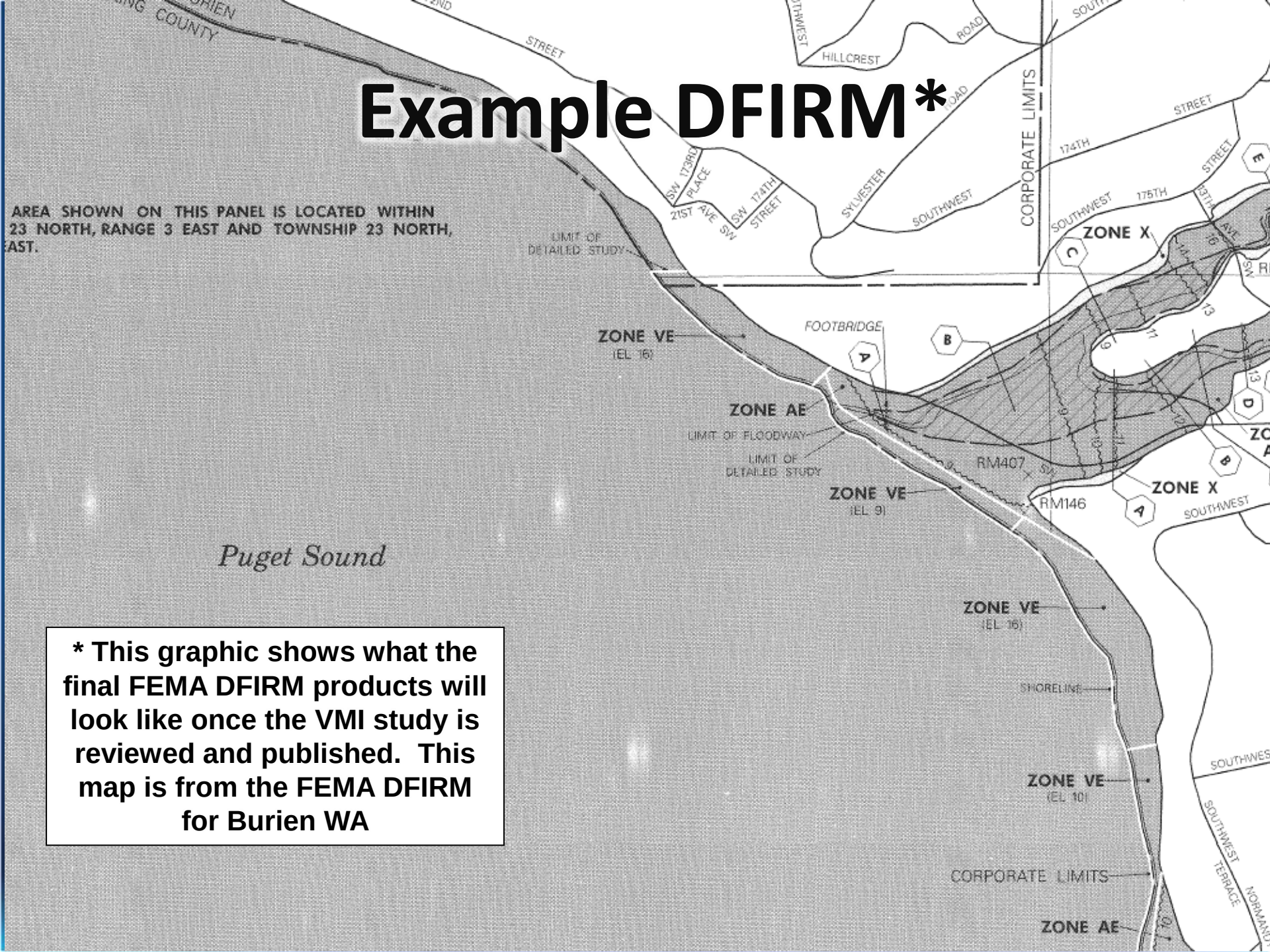
Floodplain Mapping

For Entire Vashon-Maury Island Coastline:

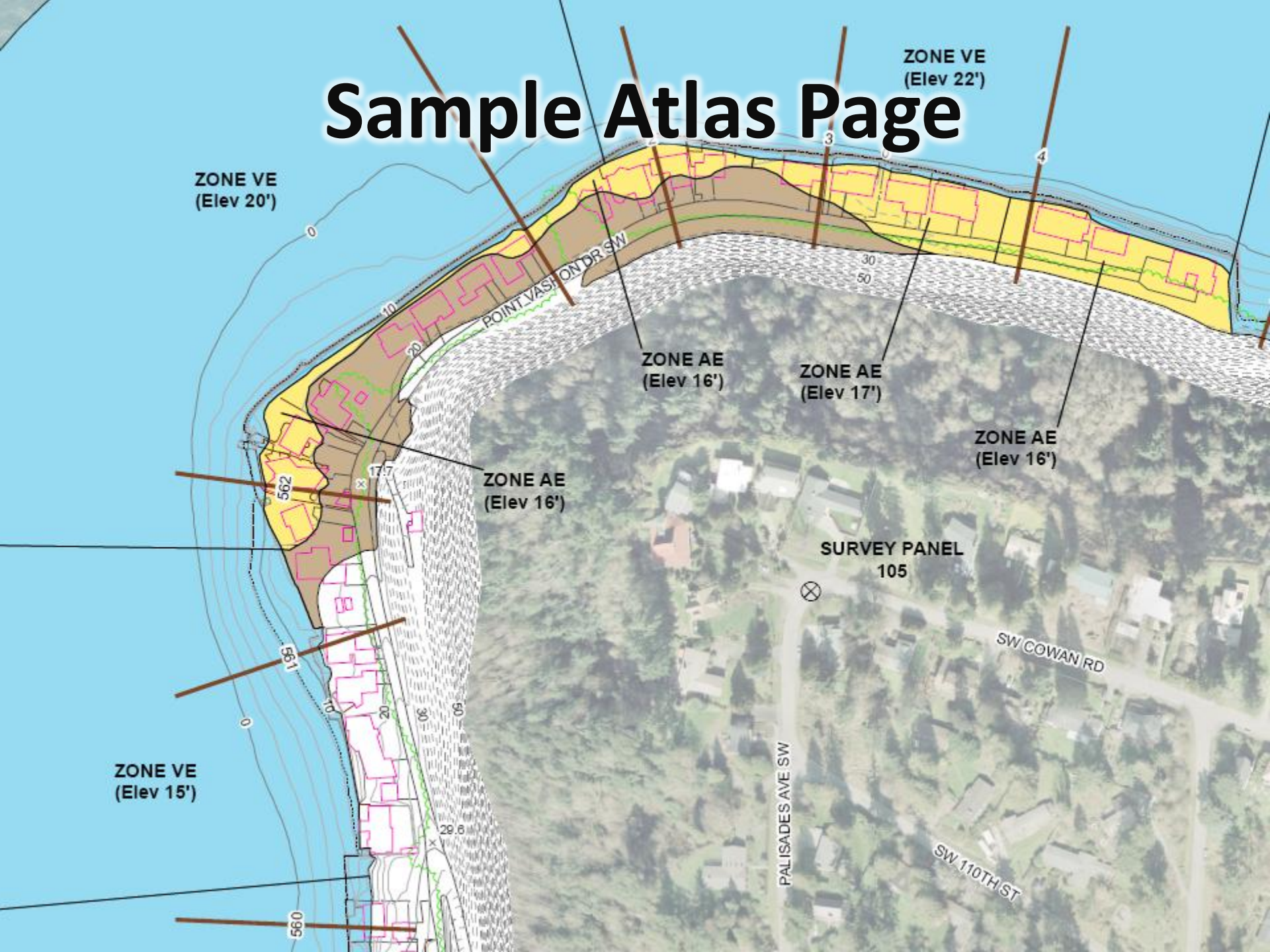
- 100-year Total Water Levels mapped
- VE and AE Zones delineated according to FEMA Pacific Coast Guidelines
- Work maps produced at a scale of 1 inch = 500 feet
- FEMA DFIRM database created
- Flood Hazard Atlas produced at scale 1 inch = 200 feet
- Mean High Water – Important Regulatory Elevation


Sample from Work Map
MATCH TO PLATE 4
MATCH TO PLATE 7
MATCH TO PLATE 6
LEGEND
PLATE INDEX
1
2
8
3
7
4
6
5
DRAFT
Vashon-Maury Island Work Map
King County, Washington
nhc
northwest hydraulic consultants
King County
King County
River and Floodplain Management Section
March 11, 2011
PLATE 5

Example DFIRM*



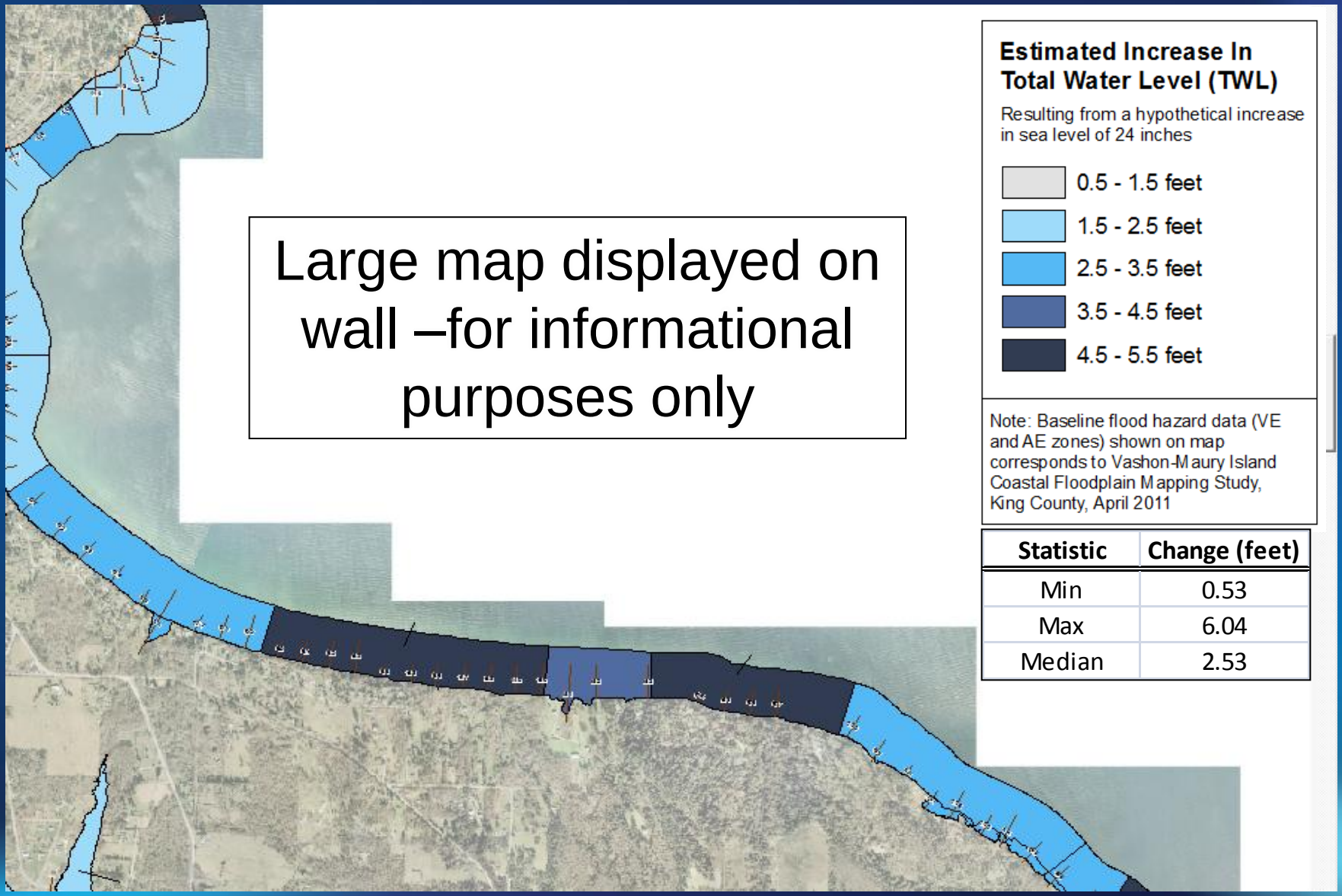
*** This graphic shows what the final FEMA DFIRM products will look like once the VMI study is reviewed and published. This map is from the FEMA DFIRM for Burien WA**


Sample Atlas Page
ZONE VE
(Elev 22')
ZONE VE
(Elev 20')
ZONE AE
(Elev 16')
ZONE AE
(Elev 17')
ZONE AE
(Elev 16')
ZONE AE
(Elev 16')
SURVEY PANEL
105
ZONE VE
(Elev 15')
POINT VASHON DR SW
SW COWAN RD
PALISADES AVE SW
SW 110TH ST

Sea Level Rise Scenario

- Based on assumption of 2 foot increase in sea level (tidal water surfaces).
- Wave runup and overtopping recomputed with revised tide data
- Changes in coastal flood hazard (total water levels) mapped for assumed sea level rise
- Estimated increase in TWL ranged from 0.5 to 6 feet

Sea Level Rise Scenario



Statistic	Change (feet)
Min	0.53
Max	6.04
Median	2.53

Large map displayed on wall –for informational purposes only

Switch to FEMA Presentation

Coastal High Hazard Area Flood Regulations

- Why do we need new flood regulations?
  - Current maps designate coastal area as flood zone "A"
  - King County has flood regulations for "A" zones
  - New maps will establish AE and VE
  - King County has flood regulations for the AE zone but not the VE zone
- National Flood Insurance Program requirement

Summary of New Coastal High Hazard Area Flood Regulations

- Elevate new buildings and substantial improvements on pilings and columns.
- Non-supporting open lattice-work allowed under finished floor.
- The lowest floor must be three feet above the 100-year flood elevation (current code).
- The foundation must be anchored to prevent flotation, collapse and lateral movement.

Summary of New Coastal High Hazard Area Flood Regulations Cont.

- A registered professional engineer or architect must prepare the structural design.
- All new buildings must be landward of mean high tide.
- The space below the lowest floor must be free of obstruction and used only for parking, access or storage. No human habitation is allowed below the lowest floor.
- Fill is not allowed for structural support.

Summary of New Coastal High Hazard Area Flood Regulations Cont.

- FEMA elevation certificate required.
- Manufactured homes must meet the same standards as new buildings or substantial improvements to existing buildings.
- Recreational vehicles must be on site for fewer than 180 days or be ready for highway use.

SEPA Threshold Determination

- King County has issued a State Environmental Policy Act (SEPA) Threshold Determination of Non-Significance for proposed regulations
- Comment period April 21 to May 13
- No administrative appeal

How Can I Comment on Regulations and SEPA Threshold Determination?

King County River and Floodplain Management
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Priscilla.kaufmann@kingcounty.gov

Comments must be received by May 13, 2011

Upcoming Milestones

Coastal Flood Hazard Maps and Study:

May – Receive public comments

July – Revise Study as Necessary and Provide Draft Maps and Technical Data to FEMA for Review

July – September (?) – FEMA Review

2012 – FEMA Preliminary Flood Insurance Rate Map and Study

Mapping Study Contacts

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